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U1S S1819 S1856

(56) Documents Cited

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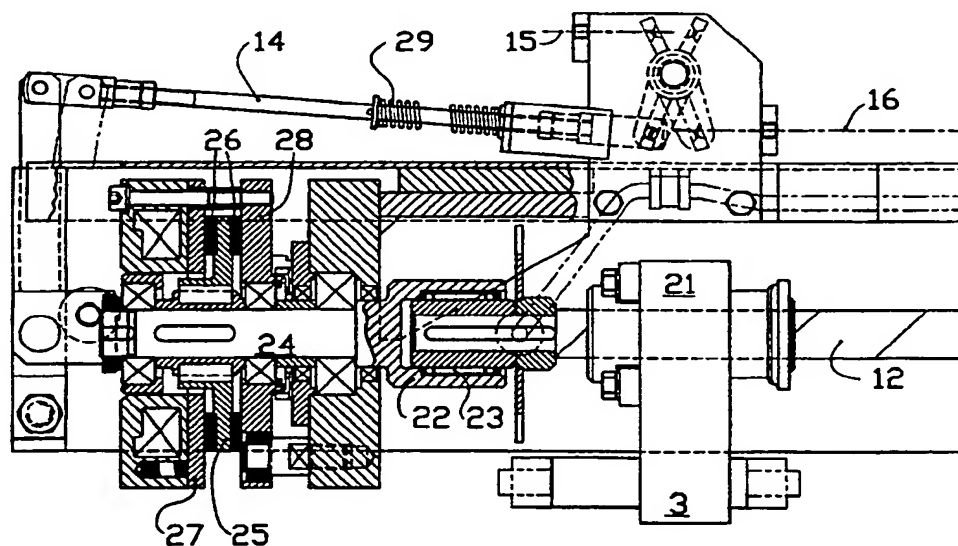
(58) Field of Search

UK CL (Edition ) E2M  
INT CL<sup>5</sup> E05F 15/14 15/16  
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## (54) A swinging-sliding door

(57) The invention relates to a swinging-sliding door with at least one door leaf suspended by means of a sliding carriage 3 on a rail so that it is axially displaceable and can swing about the rail, and which is guided by door guides (5, 6, 7, 8 Fig. 2). In order to eliminate the risk of entrapment, the invention provides for the operating mechanism to be electrically actuated and to act on a spindle 12 which operates the door via a nut 21. The end of the spindle remote from the operating mechanism is attached to a seating 22 via a free-wheel 23 which allows the spindle to turn in the direction which corresponds to the closure movement of the door, even when the seating is locked. The latter is mounted to be alternatively rotationally fixed or rotatable by means of a clutch comprising clutch disc 25, clutch linings 26 and counter discs 27, 28. The clutch is released automatically upon door opening or, in an emergency, by manual override.

Fig.5



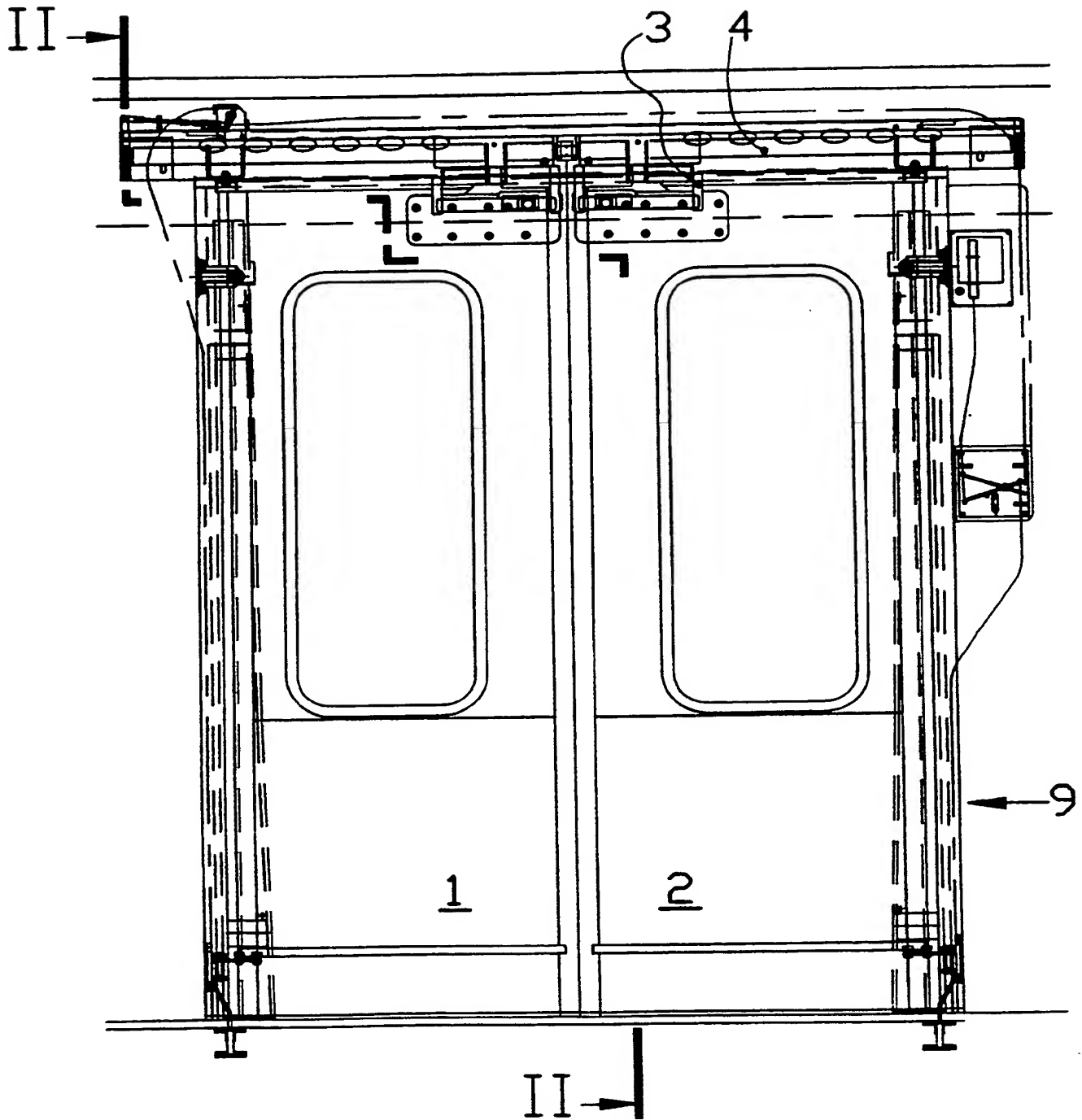
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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

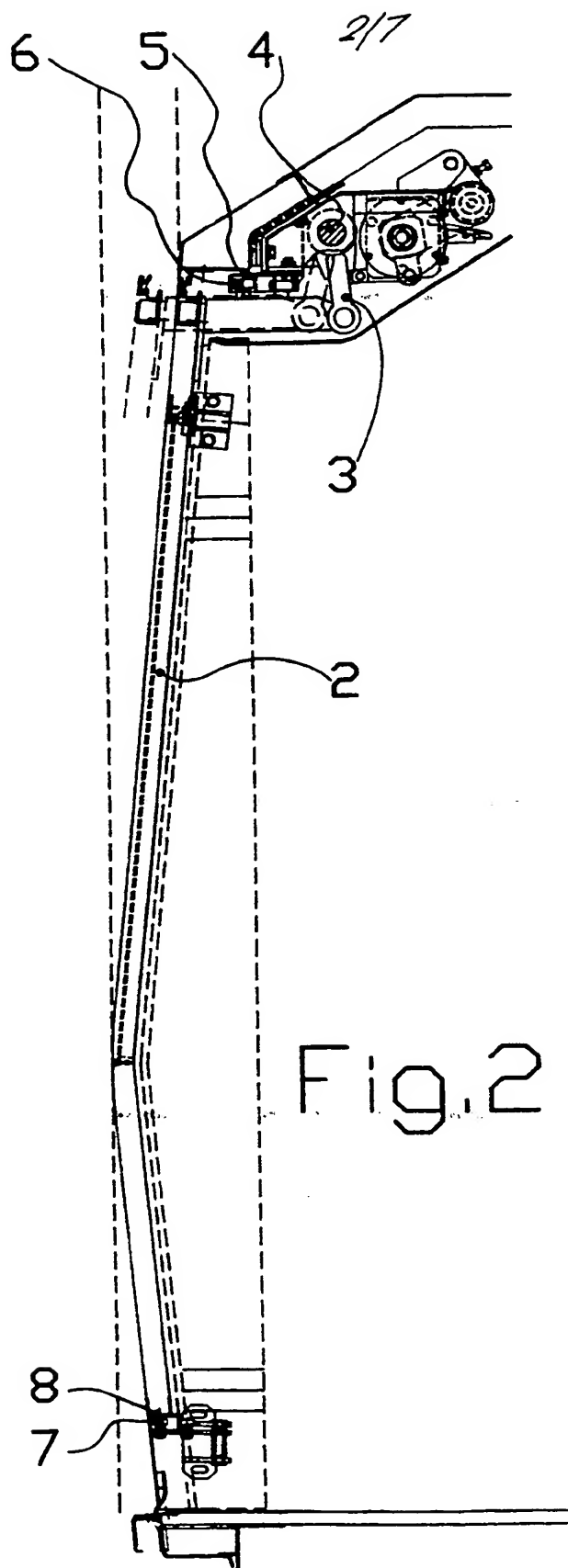
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Fig.1



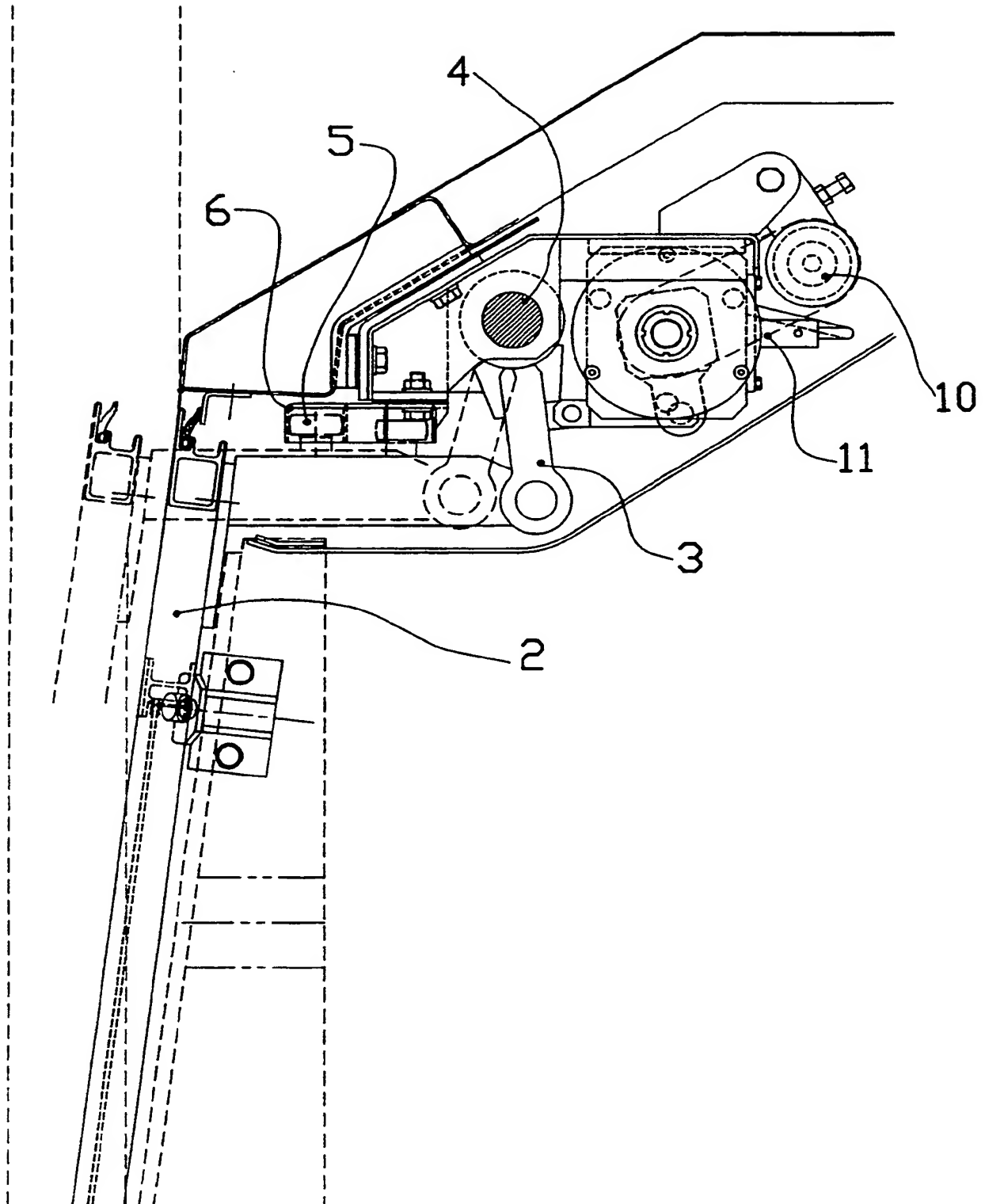
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Fig.3



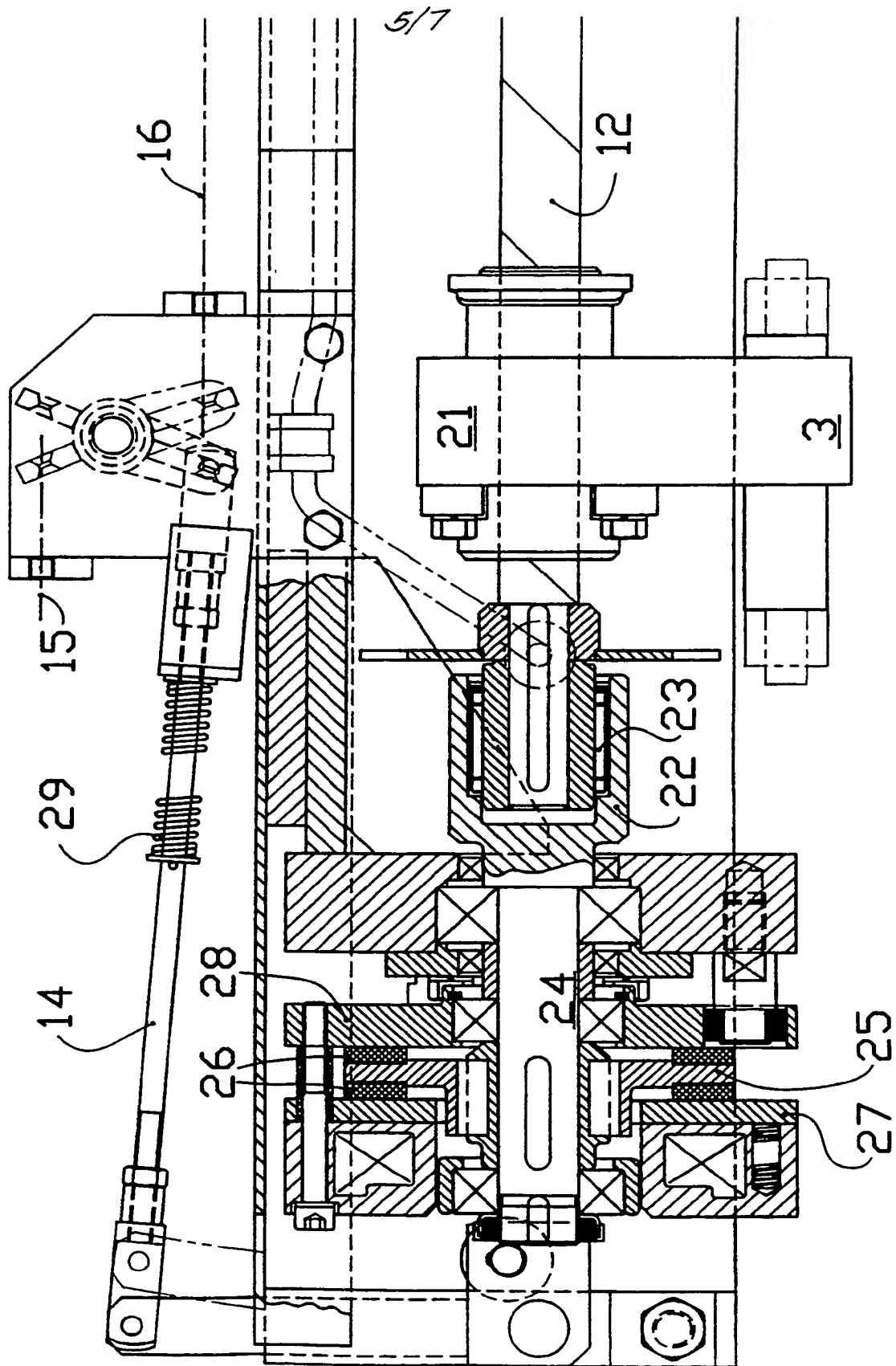
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FIG. 5



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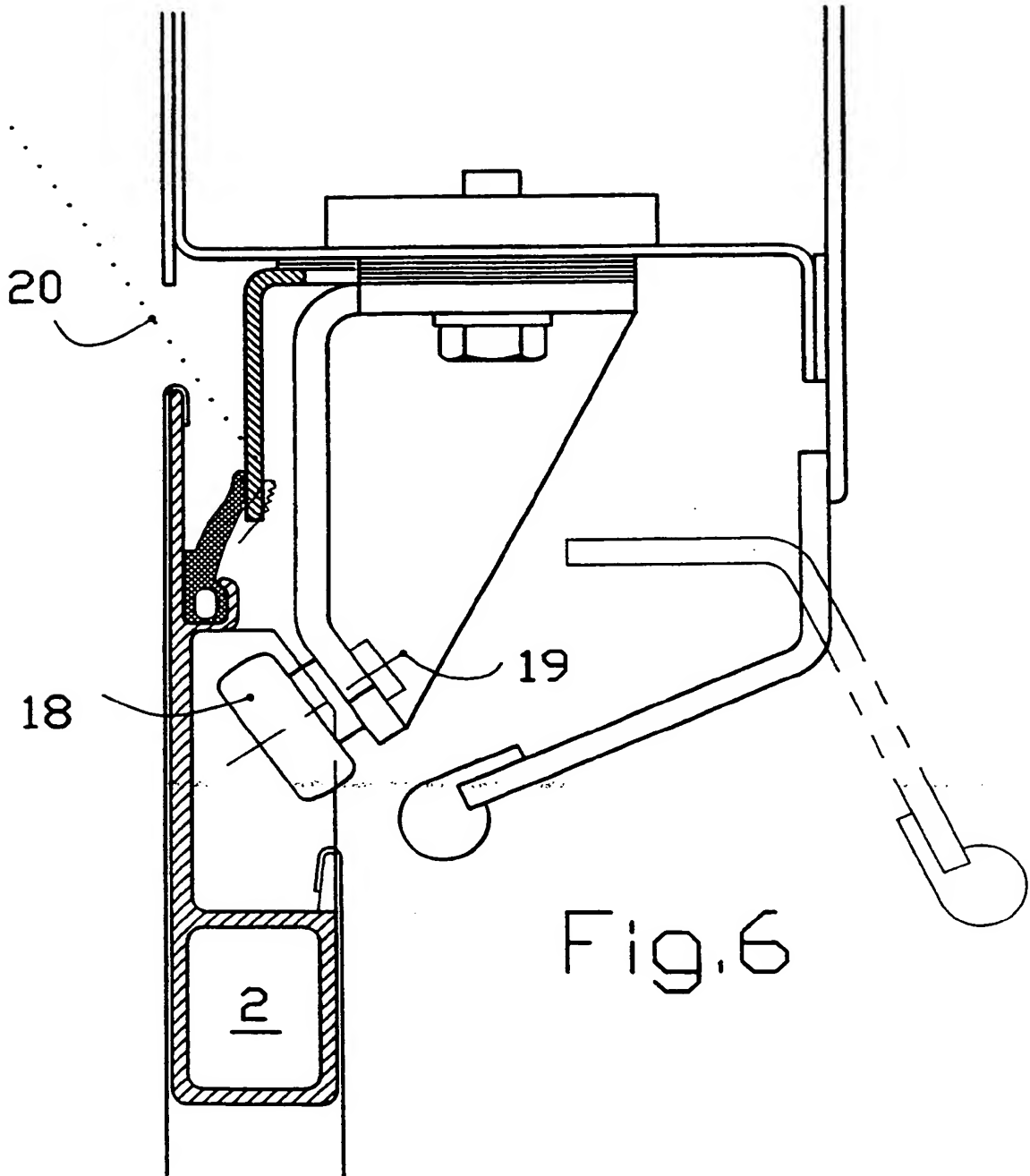
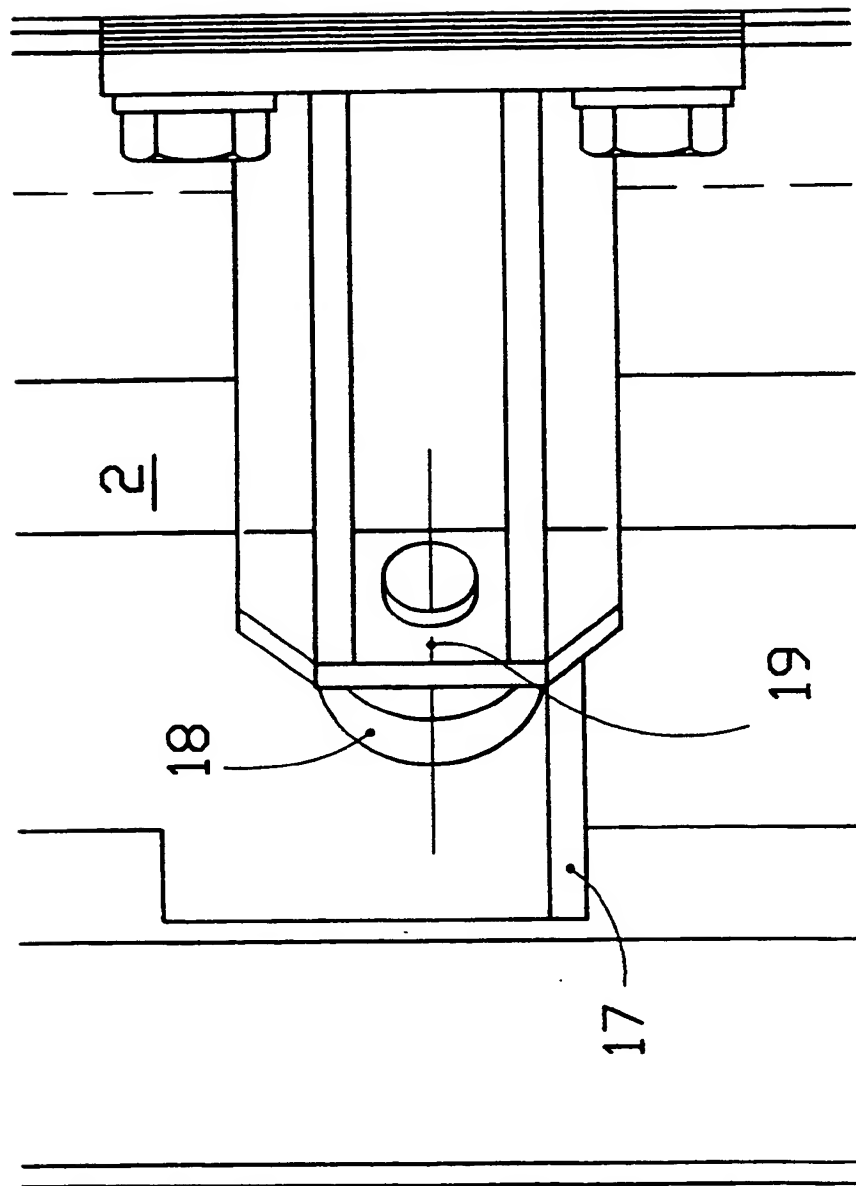


Fig. 6

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Fig. 7



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A SWINGING-SLIDING DOOR

This invention relates to an electric swinging-sliding door, particularly for vehicles.

5 A swinging-sliding door of this type is disclosed, for example, in DE-C 36 30 229. This document discloses a door with two door leaves, each leaf having an upper and a lower guide rail in each of which at least one roller engages. The vertically extending axis of rotation of the rollers can swing about a vertically extending door beam tube, this swinging movement causing the outward opening movement of the door.

10 Since the electrical operating mechanism can only be supplied with current whilst the door is being operated, a dead centre mechanism is necessary for locking the door; this ensures that manipulating the closed door cannot lead to the door opening.

15 This dead centre mechanism also determines that the door is not locked until it has completely retracted into its final closed position, so that any failure of the operating mechanism or any obstacle which prevents complete closure of the door has the effect that the door can be opened as a result, for example as a consequence of the vibrations of the moving vehicle. Secondly, the dead centre mechanism has to be accurately adjusted, which is difficult under harsh operating conditions and due to the large differences in temperature which occur, and which is therefore a disadvantage.

20 A further substantial disadvantage is the use of the door beam tube which is associated with each door leaf and is located at the edge of the door aperture in the region of the side closure edge; this door beam tube can only be covered with difficulty when the door is open, and even then cannot be concealed completely. During the closure of the door,  
25 the door beam tube in the region of the side closure edge constitutes a primary source of danger, particularly to children, to the elderly and to frail persons looking for a hold.

30 Problems also arise during adjustment because the door beam tubes have to be installed and adjusted both in the floor region and in the roof region. It is not necessary to provide any particular proof of the problems arising in this respect in all three axial directions.

Swinging-sliding doors with pneumatic or hydraulic operating mechanisms have also existed for a long time. These are disclosed, for example, in AT-B-188 323, and comprise door leaves which are guided by means of a sliding carriage so that they are longitudinally displaceable and can swing about a fixed circular supporting tube. The  
5 corresponding guide rails for the outward opening movement and the longitudinal guidance are disposed on the vehicle in the region of the door upper edge and the door lower edge, and corresponding guide rollers are provided on the door leaf.

Actuation takes place via a cylinder-and-piston unit, various lever and scissor  
10 mechanisms having been proposed in order to reduce the installed width. These doors lock in their closed position in the region of the side closure edge by means of a mechanism provided there, so that they remain closed in the event of a pressure failure in the operating mechanism, even when the vehicle is moving. This lock in the region of the side closure edge, which is at the level of the door handle and which protrudes  
15 beyond the exposed profile of the door, constitutes just as great a source of danger as the door beam tube in the construction cited initially.

The object of the present invention is to create an electrically operated swinging-sliding door which does not have the above-mentioned disadvantages, which is easy and simple  
20 to install and dismantle, and which in particular is simpler to adjust. A further object is to free the side closure edge from obstacles, and from items and installations constituting a risk of entrapment.

These objects are achieved according to the invention by combining an electrically  
25 operated spindle drive with a swing-out mechanism, in which the door is pivotally suspended via a sliding carriage on a rail, wherein the spindle drive is provided on its side remote from the operating mechanism with a free-wheel and with a releasable brake or coupling which prevents the rotation of the fixed part of the free-wheel. This thus constitutes a self-adjusting, continuous door locking system.

30 Due to this measure, both the door beam tube and the undesirable door beam become superfluous.

In one form of construction, a door support is provided in the form of a roller fastened to the door frame in the region of the side closure edge of the door, above the usual heights of the handles and preferably near the upper edge of the door, and is thus also concealed by the covering of the door operating mechanism. The axle of the roller is substantially horizontal and is normal to the direction of movement of the door in its final closure region, and cooperates with a supporting face of the door which comes to lie under the roller.

This surprisingly results in a significant improvement in the stability of the door in its closed state, since any attempt to open the door, whether by passengers or due to pressure shocks from passing trains, results in the door being lifted in the region of the side closure edge. Due to the support, lifting and thus ejection and opening are effectively prevented.

Other advantages and details are explained in particular by means of the description of the drawings, the Figures comprising the following illustrations:

Figure 1 is an internal view of a door according to the invention with the cladding removed;

Figure 2 is a section along the line II-II of Figure 1;

Figure 3 is a view of the upper part of Figure 2, on an enlarged scale;

Figure 4 illustrates the end of the spindle remote from the operating mechanism;

Figure 5 shows the above end in detail;

Figure 6 is a plan view of the support, on an enlarged scale; and

Figure 7 is an internal view of the support

The door according to the invention which is illustrated in Figure 1 has two door leaves 1, 2, which are each pivotally attached by means of a sliding carriage 3 to a rail 4. The operating mechanism itself, together with the spindle, is not shown.

Figure 2 is a sectional view along II-II of the door shown in Figure 1. The rail 4, about which the sliding carriage 3 is mounted so that it can swing, can be seen in section in

the upper region of the door. The door 2 is shown once in its closed position flush with the vehicle body, and in addition its swung-out, open position is indicated by the faint lines in the upper region.

- 5     The door itself is guided in its upper region by guide rollers 5 which run on a rail 6, and in its lower region by swing-out rollers 7 and associated guide rails 8 in the door.

The entire region of the side closure edges 9 situated between the guide rollers or rails is free from built-in items which would constitute an entrapment hazard.

10

The operating mechanism region is illustrated in Figure 3, as a view corresponding to that of Figure 2 but on an enlarged scale. The Figure shows the actual drive motor 10, which sets a spindle in rotation via a toothed belt or a V-belt 11.

- 15     A nut 21 is rigidly attached to each door 1, 2 or its sliding carriage. The nut is moved axially by the rotation of the spindle 12, which results in the door being opened or closed. Synchronisation of the two doors is effected by providing for symmetrical construction of the spindle movements with respect to the plane of symmetry of the door.

20

Figure 4 is a view corresponding to that of Figure 1, showing the end of the spindle 12 which is remote from the operating mechanism 10, and which hides the rail 4. An emergency actuating device 13, by means of which the coupling or the brake of the free-wheel can be released, is shown in detail in this Figure.

25

In order to release the brake by an emergency actuation and thus to make it possible to open the door manually, an actuating rod 14 has to be moved against the force of a spring 29, to the right as shown in the Figure. This can be effected manually by means of a Bowden cable 15, or in normal operation by releasing the electromagnetic coupling.

30

Figure 4 also illustrates the support disposed in the upper door region for stabilising the position of the door in its closed state. However, this support is also illustrated on a

larger scale on the door 2 of Figure 7. A running surface 17 is provided on the door 1; it runs substantially horizontally and is disposed at the side closure edge. When the door is in its closed state this running surface 17 cooperates with a roller 18 which comes to lie above the running surface 17 and which rests on the latter.

5 The roller can rotate about a substantially horizontal axis 19, the axis having a position which can be seen more closely from Figure 6, for the door 2 at least. In the final region of the closure operation the door moves essentially in the direction of the line 20. The axis 19 of the roller 18 is normal to the final closure direction 20.

10 As can again be clearly seen from Figure 4, the door is of unsupported construction in the region of its side closure edge. Any attempt to open the door therefore causes a moment to be built up about an axis which is approximately horizontal and normal to the plane of the door, so that this results in the door being twisted approximately about its  
15 suspension on the sliding carriage. This torsion leads to the door being lifted in the region of the side closure edge 9. The lifting is effectively prevented by the support 17, 18, the height of the support having no effect on its action. This means that it is possible for the support to be disposed within a height region in which neither the entrapment of a passenger nor any particular accumulation of dirt during operation are  
20 to be feared. This region is preferably situated near the upper edge of the door, so that the covering of the door operating mechanism also conceals the support.

Figure 5 illustrates an embodiment of a free-wheel which can be employed according to the invention, together with a brake. The view shows the end of the spindle 12 remote  
25 from the operating mechanism 10, together with the nut 21 attached to the door via the sliding carriage 3, with the door in its open position.

The end of the spindle 12 is tiltably mounted in a seating 22, which at the same time comprises a conventional free-wheel 23. When the seating 22 is held rotationally fixed  
30 the free-wheel 23 permits a rotary movement of the spindle 12 in the direction which corresponds to the closure of the door 1, 2.

To open the door, i.e. to rotate the spindle in the opposite direction, it is necessary to release the seating 22 so that it can rotate together with the spindle 12. This is achieved as follows: the seating 22 is rigidly attached to, or is formed in one piece with, a shaft 24, which is mounted so that it can rotate in relation to the vehicle body and is attached to a clutch disc 25 which bears clutch linings 26 on both its faces.

Counter-discs 27, 28 are constructed on both sides of the clutch disc 25 as viewed in the axial direction; these counter-discs are rotationally fixed in relation to the vehicle body and are axially displaceable in relation to the shaft 24. If the rod 14, the two positions of which are indicated, is moved to the right, the two clutch discs 27, 28 are axially disengaged by the twisting of a cam, due to which the disc 25 attached to the shaft 24 and situated between them is also released; this permits the seating 22 to rotate with the spindle 12 in the direction of opening.

This disengagement is effected automatically by the door operating mechanism each time the door is opened, or manually by means of the Bowden cable 15 in an emergency. Depending on the safety philosophy of the user, the brake can either be applied again after manual actuation or held in the open position by means of a lever mechanism which is not shown. In one case proper closure and further operation of the door is possible, in the other case it is possible to ascertain an improper actuation and to take measures against this.

The special arrangement of the free-wheel and the brake ensures that instead of a final closure position which is fixed, by the dead centre for example, a final closure position range exists within which the door is secured against unwanted opening. This results in a considerable simplification of the installation, since it is no longer necessary to take into consideration sealing rubber of different widths, for example.

The door according to the invention is not restricted to the embodiment described above. Thus it is possible to drive the spindle by other means, for example by means of toothed gearing or, space permitting, by means of a motor flanged coaxially to the spindle.

The support 17, 18 may be constructed differently and, if it is only a matter of unauthorised opening by the user, may be formed by two support faces, for example, which in normal circumstances are disposed at a slight separation from each other and which can be lubricated under some circumstances in order to reduce wear.

5

However, it is also possible to provide two support faces 17 on the door, one of which is situated under the support roller as illustrated and the other of which comes to lie above the support roller, so that with the door in its closed state the sliding carriage 3 and the support rail 4 are relieved of their load. Of course it is also possible to provide the roller on the door and the support face on the vehicle body.

10

Another form of the invention, which relates to the engaging and disengaging free-wheel, is the arrangement of the latter coaxially with the spindle 12. If the space near the door aperture is insufficient for the embodiment illustrated, it is a simple matter to one skilled in the art to dispose the free-wheel together with the releasable brake obliquely above, similar to the door operating mechanism shown, and to the inside of the spindle 12 as seen from the vehicle, and to create an operating connection by means of a V-belt or toothed belt, toothed gearing or a chain or the like. Apart from shortening the overall length, this also has the advantage that the spindle 12 can be mounted securely at both ends, and that the brake can also be mounted in its own right, because the operating connection is capable of compensating for mounting errors and axially skew positions and the like.

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The brake may be of either non-positive (frictional coupling) or positive (toothed coupling) construction.

CLAIMS

1. A swinging-sliding door, particularly for vehicles, with at least one door which is suspended by means of a sliding carriage on a rail so that it is axially displaceable and can swing about the rail and which is guided by door guides, wherein the operating mechanism is actuated electrically and acts on a spindle, wherein a nut which cooperates with the spindle is attached rotationally fixed to the door, and wherein the end of the spindle remote from the operating mechanism is attached to a seating via a free-wheel, wherein the free-wheel allows the spindle to turn in the direction which corresponds to the closure movement of the door, even when the seating is locked, and wherein the seating is mounted alternatively rotationally fixed or rotatable by means of a positive or non-positive brake, coupling or the like.

20

2. A swinging-sliding door according to Claim 1, wherein a running surface is disposed on the door in the region of the side closure edge, preferably near the upper edge of the door, which running surface comes to lie substantially directly below a counter-support face disposed on the door frame with the door in its closed state.

3. A swinging-sliding door according to Claim 2, wherein the counter-support face is a roller which can swing about a substantially horizontal axis which is substantially normal to the final closure movement of the door.

4. A swinging-sliding door according to Claim 2 or 3, wherein an additional running surface is



provided on the door, and is disposed substantially directly above the counter-support face.

5. A swinging-sliding door substantially as  
5 hereinbefore described with reference to and as  
illustrated in the accompanying drawings.

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**Relevant Technical Fields**

- (i) UK Cl (Ed.L) E2M  
(ii) Int Cl (Ed.5) E05F 15/14, 15/16

**Databases (see below)**

(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii) WPI

Search Examiner  
R E HARDY

Date of completion of Search  
22 DECEMBER 1993

Documents considered relevant  
following a search in respect of  
Claims :-  
ALL

**Categories of documents**

- |   |   |
|---|---|
| <b>X:</b> Document indicating lack of novelty or of inventive step.   | <b>P:</b> Document published on or after the declared priority date but before the filing date of the present application.        |
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| <b>A:</b> Document indicating technological background and/or state of the art.   | <b>&amp;:</b> Member of the same patent family; corresponding document.   |

Category	Identity of document and relevant passages	Relevant to claim(s)
X	GB 1413880 A (VAPOR) note the one-way clutch 67, Figure 4	at least Claim 1

**Databases:** The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).